JACKPILE MINE RECLAMATION: HIGHWALLS AND PITS

NORTH PAGUATE PIT

Two blackfill cases in the North Paguate Pit area were calculated. To permit the calculation of backfill quantities, two sets of cross-sections were developed. The locations of the cross-sections are shown on Map 1. Ten west-east oriented cross-sections were drawn of the western pit area and 36 north-south cross-sections were drawn to cover the highwall and pit from the western pit area east to the highwall junction with the "Rabbit Ear" dump area. The cross-sections are depicted in Figure 1.

The first backfill case involved backfilling the north highwall to a maximun slope of 3 horizontal to 1 vertical from the highwall south of Paguate Village eastward to the "Rabbit Ear" dump. The quantity of backfill material required to accomplish the 3:1 backfill slope of the highwall was calculated to be 2,163,700 cubic yards or 3,505,000 tons.

The second backfill case involved backfilling the pit bottom to an elevation ten feet above the estimated long term ground water recovery level as calculated by the BIA hydrologists. The pit bottom backfill quantity was calculated to be 7,330,700 cubic yards or 11,875,800 tons in addition to the highwall backfill slope quantity calculated for the first case. Pit bottom backfill quantities do not include the far eastern portion of the North Paguate Pit extending eastward of the highwall junction with the "Rabbit Ear" dump.

The methodology used to calculate the above listed backfill quantities is as follows:

> The existing ground surface was plotted from the 100 scale topographic maps and transferred to the appropriate cross-sections; the backfill slope of 3:1 was added to the cross-section and each backfill slope area was planimetered three times to derive a reliable average backslope area for each cross-section. An area of influence of 50 feet on each side of every cross-section was used to calculate the volume for that cross-section; the slope backfill volumes for each cross-section were added up to arrive at a total volume in cubic yards for the north highwall backfill slope totals for the area south of Paguate Village to the highwall junction with the "Rabbit Ear" dump. A conversion factor of 1.62 tons/cubic yard was applied to the slope backfill volume totals to arrive at the total tonnage amount of backfill required. The backfill slope lines representing the post backfilling surface are shown on the cross-sections and the outline of the area covered by this 3:1 backfill slope is also shown in green pencil on sheets #5 and 6 of the Anaconda 100 scale topographic maps. For the second case, the BIA projected long term ground water recovery level was added to each cross-section and a pit bottom backfill line was plotted at ten feet above the estimated ground water table elevation. The area of pit bottom backfill (in addition to the highwall 3:1 backfill slope) was planimetered and backfill volumes for each cross-section were tabulated and totaled for the North Paguate Pit. Note that the pit area east of the "Rabbit Ear" dump was not included in the backfill calculations.

SP-20 PIT

In the SP-20 Pit area the amount of backfill required to backslope a 3:1 surface from the top of the highwall to the pit floor was calculated using similar methodology to that used for the North Paguate Pit. Twelve pit cross-sections (Figure 2) were drawn from a baseline off the south-west highwall. The locations of the cross-sections and fill area are shown on Map 2. The volume of backfill required was derived by planimeter and totalled 2,191,900 cubic yards or 3,550,800 tons.

SOUTH PAGUATE PIT

In the South Paguate Pit area one backfill case was calculated. This case involved backfilling the entire pit to the approximate pre-mining ground surface. Because of the large area covered by the South Paguate Pit, three separate sets of cross-sections were drawn to permit calculation of backfill volumes. Thirteen west-east cross-sections were drawn to cover the central pit area. Twelve north-northwest to south-southeast cross-sections were drawn to cover the south highwall area and seventeen cross-sections oriented north-south were drawn to cover the north highwall area. The cross-sections are depicted in Figure 3. The locations of the cross-sections and fill area are shown on Map 3.

Because of overlap of some of the cross-sections, combinations of the quantities derived for the individual cross-sections were measured by planimeter and carefully combined to calculate backfill volumes for the entire pit. The estimated backfill volume to achieve approximate pre-mining topography was calculated to be 17,815,200 cubic yards or 28,860,700 tons of backfill material. The long term ground water recovery level as estimated by BIA hydrologists is shown on some of the cross-sections. If the South Paguate Pit is completely backfilled to achieve approximate pre-mining topography, a drainage channel from the east side of the backfilled pit to the Rio Paguate would need to be constructed to adequately drain the backfilled pit area.

BACKFILL COST ESTIMATES

In the conduct of the work, it was concluded that deriving a detailed cost estimate for the various backfill cases would be difficult due to uncertainties of location for obtaining sufficient quantities of suitable backfill materials to achieve all of the desired backfill levels.

Estimate of costs relating to these types of operations was obtained from other mining and large scale earth moving operations. To provide meaningful comparative cost estimates, the size (daily volume) of the earth moving operation must be known as well as the minimum, average and maximum haul distances and the related haulage profiles along with the type of earth materials and equipment assigned to best handle the job. Another relevant cost related factors would be whether the job were handled entirely by a contractor on a turn-key basis or solely by the Laguna Tribe. These and other job related factors have considerable bearing on the actual costs which could be incurred during the job. Backfilling costs presented below are for backfilling the North Paguate Highwall at a 3:1 slope, the following assumptions were used:

1) Turn-key operation using contractor equipment and personnel;

2) No blasting required for borrow material;

3) One-shift/day equipment operations;

4) Large front-end-loader and off-highway haulage trucks are primary loading and hauling equipment;

5) Sufficient borrow material exists along south side of North Paguate Pit to complete backslope backfilling needs of 3,505,200 tons;

6) Costs include all support equipment, maintenance requirements, supervision and profit;

7) Equipment spread average production level of 6,000 cubic yards or 9,720 short tons per day;

8) Three haul distance cases are included for a 2,000 foot, 4,000 foot and 6,000 foot one-way haul.

The total costs and unit costs are as follows:

	One Way Haul Distance	Total Cost	Unit Cost
Case 1	2,000 foot haul	$4,451,604.00	$1.27/ton
Case 2	4,000 foot haul	$5,503,164.00	$1.57/ton
Case 3	6,000 foot haul	$6,449,568.00	$1.84/ton

These costs are typical for the backfill work to be accomplished. The higher costs associated with the longer hauls illustrate the importance of job efficiency planning to locate borrow material close as possible to the backfill locations.